

# Is colonization of Mars in this century realistic?



This resource is a **wikidebate**, a collaborative effort to gather and organize all arguments on a given issue. This is **not** a place to defend your preferred points of view, but original arguments are allowed and welcome. See the [Wikidebate guidelines](#) for more.

Some individuals and organizations aim to establish human colonies on Mars, our nearest neighbor and the planet most similar to Earth in the Solar System. Is human colonization in the 21st century realistic or possible? In less ambiguous terms, is human settlement possible on Mars in the 21st century?



**Subject classification:** this is a science resource.

## Colonization of Mars in this century is realistic








### Arguments for

- **Argument for** It could be possible if water was found on Mars and robots can be used to process water and obtain hydrogen from it as fuel.
- **Argument for** NASA and Elon Musk are making serious effort in that direction. With enough spirit and effort, it should be doable.
  - **Objection** Given they are not running a new analog of Biosphere 2, their effort seems to be not really serious.
  - **Objection** Nobody is actually putting resources in a particular direction, for example developing a new Biosphere 2. If no one is putting resources there, why should we believe anyone is genuinely serious about colonizing Mars?
  - **Objection** That is very inconclusive. Spirit and effort are far from sufficient to make something feasible.
    - **Objection** If they did not believe it was feasible, they would not spend the effort.
      - **Objection** They may spend the effort anyway: perhaps they think aiming at an extremely ambitious if unrealistic aim can bring about technology useful for other purposes. Indeed, previous space research contributed to useful technologies<sup>[1]</sup>; see also NASA spinoff technologies.
      - **Objection** They may spend the effort anyway: perhaps they think the aspirational effort will attract people into STEM fields (science, technology, engineering, math).

### Arguments against

- **Argument against** The low gravity and exposure to ionizing radiation are intractable problems, and whether a healthy human population can live with such problems is

unknown. That is so even if some aspects of Martian human-habitation-hostility can be terraformed away with present day technology or plausible developments this century.

-  **Argument against** There is no economically viable reason justifying an effort to colonize Mars, and without one, any colonization effort will run on a finite supply of political will and will fail once that is exhausted.
  -  **Objection** Colonization of Mars would allow us to exploit the natural resources available on Mars, which would give us a continued source even if the finite resources on Earth ran out.
-  **Argument against** A fifth of the 21st Century has already passed and humanity hasn't gone 1000 km from Earth since the 1970s. There are no rotating wheel space stations with artificial gravity. There are no permanent Lunar bases. There are no spacecraft that landed on Venus with instruments that lasted an Earth-day. Humanity has yet to go 0.1% the speed of light (over 299 km/s or 1.08 million kph). Therefore, reaching Mars before 2100 seems very unlikely.
  -  **Objection** Most of that does not appear directly relevant to colonization of Mars; it merely bemoans general lack of progress.
-  **Argument against** Closing the biological material loop is hard. The feasibility should be demonstrable on the Earth. It was tried as part of Biosphere 2 project. The first Biosphere 2 experiment lasted 2 years, and required injections of oxygen. The second Biosphere 2 experiment was ended prematurely. If a perfectly closed mini-biosphere with a crew lasting at least a few years cannot be demonstrated on Earth with its sunlight, gravity, lack of radiation, and no dust storms, one should hardly believe it is feasible to do on Mars.
  -  **Objection** Mars is
  -  **Objection** Biosphere 2 aimed at oxygen closure. By contrast, oxygen on Mars could be produced from CO<sub>2</sub> by the likes of Mars Oxygen ISRU Experiment

## Relevant facts about Mars

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A summary of key relevant facts from Wikipedia and other sources:

- Mars has an unbreathable atmosphere: 95% carbon dioxide, 3% nitrogen, 1.6% argon, and less than 0.4% of other gases, including oxygen.
- Mars atmospheric pressure is less than 1% that of the Earth.
- Mars temperature on average fluctuates between -70 and 0 °C (-94 and 32 °F).
- Mars landscape is exposed to intense ionizing radiation from solar particle events and cosmic rays, due to no magnetosphere.
- Mars surface gravity is 38% that of the Earth, slightly above 1/3.
- Mars has planet-wide dust storms.
- Mars landscape is covered by fine dust.
- Mars surface gets less than 1/2 of the sunlight received by the Earth surface<sup>[2]</sup>.
- Water on Mars is scarce, with rovers Spirit and Opportunity finding less than there is in Earth's driest desert.
- Mars has in-situ resources, such as underground water, Martian soil, and ore, which could be leveraged by colonists.
- Opportunities to generate electricity via wind, solar and nuclear power using resources on Mars are poor.

- A trip to Mars will take about 7-9 months; it takes about 3 days to get to the Moon<sup>[3]</sup>. During the trip, astronauts are exposed to high energy radiation unless shielding is provided<sup>[4]</sup>.
- A radio message from Mars to Earth travels for about 5 to 20 minutes, depending on planet positions.

## See also

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- Should we colonize Mars?

## References

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3. How long does it take to travel to the Moon? (<https://coolcosmos.ipac.caltech.edu/ask/174-How-long-does-it-take-to-travel-to-the-Moon->), caltech.edu
4. Health threat from cosmic radiation during mannedmissions to Mars (<https://www.lehman.edu/academics/education/middle-high-school-education/documents/mars.pdf>), lehman.edu

## External links

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- Wikipedia:Colonization of Mars
- Wikipedia:Terraforming of Mars
- Wikipedia:Human mission to Mars
- Space Colonization - Pros & Cons (<https://www.procon.org/headlines/space-colonization-to-p-3-pros-and-cons/>), procon.org -- Con 1 claims infeasibility
- Making Humans a Multi-Planetary Species (<http://online.liebertpub.com/doi/full/10.1089/space.2017.29009.emu>) by Elon Musk, 2017
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- Humans Will Never Colonize Mars (<https://lasp.colorado.edu/home/mop/files/2019/08/Humans-Will-Never-Colonize-Mars.pdf>) by George Dvorsky, lasp.colorado.edu
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- Mars Is a Hellhole (<https://www.theatlantic.com/ideas/archive/2021/02/mars-is-no-earth/618133/>) by Shannon Stirone (science writer), 2021, theatlantic.com
- Can Humans Live on Mars? (<https://www.engineeringforkids.com/about/news/2022/august/can-humans-live-on-mars-what-would-it-look-like-/>), engineeringforkids.com
- Can humans live on Mars? You asked Google – here's the answer (<https://www.theguardian.com/commentisfree/2017/jul/26/can-humans-live-on-mars-asked-google>), 2017, theguardian.com

- [Humans to Mars: A feasibility and cost-benefit analysis \(https://www.researchgate.net/publication/7902213\\_Humans\\_to\\_Mars\\_A\\_feasibility\\_and\\_cost-benefit\\_analysis\)](https://www.researchgate.net/publication/7902213_Humans_to_Mars_A_feasibility_and_cost-benefit_analysis), 2005 -- whether a human mission is feasible, a slightly different question
- [The Feasibility of Colonizing Mars | Science | Cégep Vanier College \(https://www.vaniercollege.qc.ca/science/the-feasibility-of-colonizing-mars/\)](https://www.vaniercollege.qc.ca/science/the-feasibility-of-colonizing-mars/), 2019, vaniercollege.qc.ca
- [Will it be safe for humans to fly to Mars? \(https://newsroom.ucla.edu/releases/safe-for-human-s-fly-to-mars\)](https://newsroom.ucla.edu/releases/safe-for-human-s-fly-to-mars), newsroom.ucla.edu
- [The Economic Viability of Mars Colonization \(https://www.aleph.se/Trans/Tech/Space/mars.html\)](https://www.aleph.se/Trans/Tech/Space/mars.html) by Robert Zubrin
- [Opinion – The Economic Flaws in Elon Musk's Mars Colonization Plans \(https://www.e-ir.info/2021/02/12/opinion-the-economic-flaws-in-elon-musks-mars-colonization-plans/\)](https://www.e-ir.info/2021/02/12/opinion-the-economic-flaws-in-elon-musks-mars-colonization-plans/) by John Hickman, 2021
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